

Activity Title: OceanQuest: Seeing the Sea Floor

Subject: Ocean floor mapping (hydrography)

Grade Level: 4-8

Average Learning Time:

- Teaching the lesson (introduction of the OceanQuest activity) — one class period
- Student research and completion — 4-5 class periods (includes research and project)

Lesson Summary (Overview/Purpose):

Using the webquest *OceanQuest* created by Teacher at Sea Alumni Stacey Klimkosky and Megan O’Leary, students will research the definition and history of hydrography, including different technologies used and the importance it plays in historic and modern ocean travel.

OceanQuest: <http://truomass.org/oceanquesthydrograhers.htm>

Overall Concept (Big Idea/Essential Question):

Students will understand that hydrography is the process of collecting data about the surface of the ocean floor through the use of technology. This technology has changed since the first government-sponsored ocean surveys were conducted in 1807. Today, NOAA hydrographers continue to survey the ocean floor for the purposes of safe navigation and ocean exploration.

Specific Concepts (Key Concepts):

Upon completion of the lesson, students will understand the definition of hydrography. They will communicate how NOAA uses hydrographic data as an important tool in navigational safety. Through the study of the history of hydrographic surveying, students will identify and explain the differences of several modern hydrographic survey tools.

Focus Questions (Specific Questions):

1. What is hydrography/hydrographic survey?
2. How does NOAA use hydrography?
3. What does hydrographic data tell us?
4. How is the data used?
5. Why is hydrography important for everyone (even someone who has never seen the ocean)?
6. Where, and under what circumstances, do hydrographic surveys need to be done (more) frequently?

7. How has the technology used in ocean floor mapping changed since it was first implemented by President Thomas Jefferson in 1807?
8. What are some of the modern technologies used to survey the ocean floor and how do they work?

Objectives/Learning Goals:

Using a 3-5 slide PowerPoint presentation, students will be able to demonstrate good to excellent knowledge (scores of 4 or 3) on all eight (8) Focus Questions stated above as defined by the OceanQuest Rubric. Students will:

1. Define hydrography/hydrographic survey as the measurement and description of physical features on the bottom of the sea floor for the primary purpose of navigation.
2. Identify the main way NOAA uses hydrography as a way to identify hazards to safe navigation through the creation and updating of nautical charts.
3. Identify that hydrographic data tells us the depth of water in a surveyed area, including the presence of any natural or human-imposed obstructions.
4. Communicate that the data collected in a hydrographic survey is used to create or update nautical charts, which are like road maps for mariners.
5. Articulate why hydrography is important to everyone, even those who have never seen the ocean or major waterway, using examples such as the transport and delivery of goods from dock to store.
6. Identify at least two (2) examples of where and under what circumstance hydrographic surveys may need to be done more frequently (sample answers include: after natural events such as hurricanes and earthquakes; at the mouths of rivers; after airplane water crashes)
- 7/8. Articulate changes in hydrographic survey technology from 1807 to the present, including list and explaining how each of the following work: lead lines, single beam echo sounders, multi-beam SONAR, side-scan SONAR.

Background Information:

Teachers should view/listen to all listed links in the Hydrographers section of *OceanQuest* (<http://truomass.org/oceanquesthydrographers.htm>). This lesson can be taught as a “stand alone” Lesson, along with the other NOAA careers listed on the “Process” page: <http://truomass.org/oceanquestprocess2.htm> . If the lesson is taught as a “stand alone, however, it is advised that teachers explain the “Seeing the Sea Floor” lesson is a part of a larger lesson, the webquest.

Common Misconceptions/Preconceptions:

n/a

Materials:

- Computer or tablet with Internet connection
- *OceanQuest* website, Hydrographers page: <http://truomass.org/oceanquesthydrograhers.htm>
- PowerPoint or other presentation software
- Optional (for “Special Challenge” part of the lesson—Building a Sounding Box):
 - Note: Lesson Plan and materials list can be found at:
http://oceanservice.noaa.gov/education/seafloor-mapping/sounding_box_make1.html
 - small box; sand, gravel or dirt; small items to sink; air filter or aluminum foil; bamboo skewer; downloadable depth chart grid; downloadable color-coded depth scale; pencil

Technical Requirements:

- Computer or tablet with Internet connection
- *OceanQuest* website, Hydrographers page: <http://truomass.org/oceanquesthydrograhers.htm>
- PowerPoint or other presentation software

Teacher Preparation:

Teachers should view/listen to all listed links in the Hydrographers section of *OceanQuest* (<http://truomass.org/oceanquesthydrograhers.htm>). This lesson can be taught as a “stand alone” Lesson, along with the other NOAA careers listed on the “Process” page: <http://truomass.org/oceanquestprocess2.htm> .

Keywords:

hydrography/hydrographic survey
lead line
SONAR
multi-beam SONAR
side-scan SONAR

Pre-assessment Strategy/Anticipatory Set:

n/a

Lesson Procedure:

1. If the lesson is being taught as a “stand alone” lesson, provide some background on the *OceanQuest* webquest, highlighting the “TASK” link (<http://truomass.org/oceanquesttask.htm>) and focusing on the Hydrographers information.

2. Direct students to the “Hydrographers” section of the OceanQuest webquest: <http://truomass.org/oceanquesthydrograhers.htm>, or by clicking on PROCESS link and then HYDROGRAPHERS. Before allowing students to work on their own, if necessary, preview each link and discuss how to utilize it to find information.

Note: Differentiation suggestions—Provide graphic organizers to fill in while listening to podcast in “Diving Deeper” section and/or “Seeing the Sea Floor” section. Listen to the podcast as a whole group. Teacher stops podcast to allow for time to fill in answers to questions on graphic organizer.

3. This lesson can be taught as a whole class activity or as an independent activity. Expectation can be for individual students to complete all of the activities on the page or to work with a partner. Students can be assigned sections (ie. Diving Deeper and Seeing the Sea Floor), complete the presentations and then work in teams or small groups to make a sounding box.

Assessment and Evaluation:

Students will complete a 3-5 slide PowerPoint (or other presentation software) presentation addressing the Objectives and Learning Goals. Presentations will be delivered to the class and evaluated based on the rubric provided in the EVALUATION link of the OceanQuest webquest. (<http://truomass.org/oceanquestevaluation.htm>). If desired, teachers may use any other means of assessment including written reports, posters, student-created plays, etc.

Author: Stacey Klimkosky
Teacher at Sea 2009 aboard NOAA Ship *RAINIER*
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Standards:

National Science Education Standards Addressed:

Science as Inquiry Standards:

Abilities necessary to do scientific inquiry; Understanding about scientific inquiry

Physical Science Standards:

Properties of object and materials; Motions and forces

Science and Technology Standards:

Abilities of technological design; Understanding about science and technology

History and Nature of Science Endeavors Standards:

Science as a human endeavor; History of science

Ocean Literacy Principles Addressed:

Principle #6: The ocean and humans are inextricably interconnected.

- b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.
- c. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures.
- e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
- f. Coastal regions are susceptible to natural hazards (tsunamis, hurricanes, cyclones, sea level change, and storm surges).

Principle #7: The ocean is largely unexplored.

- a. The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation's explorers and researchers, where they will find great opportunities for inquiry and investigation.
- b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.
- d. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.
- f. Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.

Massachusetts State Science & Technology Standards Addressed:

Earth & Space Science Gr. 6-8

Mapping the Earth: 1. Recognize, interpret, and be able to create models of the earth's common physical features in various mapping representations, including contour maps.
Heat Transfer in the Earth: 4. Explain the relationship among the energy provided by the sun, the global patterns of atmospheric movement, and the temperature differences among water, land, and atmosphere.
Earth's History: 6. Describe and give examples of ways in which the earth's surface is built up and torn down by natural processes, including deposition of sediments, rock formation, erosion, and weathering.

Physical Sciences Gr. 3-5

Sound Energy: 11. Recognize that sound is produced by vibrating objects and requires a medium through which to travel. Relate the rate of vibration to the pitch of the sound.

Gr. 6-8 Properties of Matter: 2. Differentiate between volume and mass. Define density.

Technology/Engineering Gr. 6-8 6. Transportation Technologies: *Central Concept*:
Transportation technologies are systems and devices that move goods and people from one place to another across or through land, air, water, or space.

Additional Resources:

The Surveyors: Charting America's Course

http://www.nauticalcharts.noaa.gov/staff/education_surveyors.htm

This 27 minute video is a helpful introduction to the topic of hydrography and hydrographic/coastal surveys

NOAA's Office of Coast Survey

<http://www.nauticalcharts.noaa.gov/index.html>

<http://www.nauticalcharts.noaa.gov/staff/education.htm> (Education page)

http://www.nauticalcharts.noaa.gov/staff/education_animations.htm (Multibeam and SideScan Sonar animations)